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Własności warstw napawanych łukowo z podawaniem grawitacyjnym węglika wolframu do jeziorka napoiny

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ABSTRACT

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Title: **Properties of Arc Hardfaced Layers with Tungsten Carbide Gravitationally Fed to the Overlay Weld Pool**

The study aimed at affecting the properties of layers obtained using self-shielded flux-cored arc hardfacing (where the filler metal wire had the composition of chromium cast iron) with tungsten carbide particles gravitationally fed to the overlay weld pool.

The study-related test objectives included the identification of the effect of tungsten carbide feed intensity and the distance between the feed nozzle axis and the flux-cored wire axis on the content of tungsten carbide particles and their distribution in the overlay weld as well as the optimization of hardfacing parameters in relation to the content of tungsten carbide particles. The tests involved the simulation of an actual specimen using a mathematical model developed by the Author.

The study also involved the design and construction of prototypical tooling that allows the gravitational feed of a previously set amount of tungsten carbide particles to a given area of the overlay weld pool.

The tests revealed that the content of tungsten carbide particles and their distribution in the flux-cored arc hardfaced layer depended on tungsten carbide feed intensity as well as on the distance between the axis of the carbide feed nozzle and the flux-cored wire axis. Using a three-level programme (i.e. static, determinate and complete), the Author developed a mathematical model making it possible to simulate the content of tungsten carbide particles in overlay welds. The developed mathematical model was adequate in relation to the adopted level of significance.

The study-related investigation included abrasive wear resistance tests, hardness measurements, the analysis of chemical and phase compositions as well as the performance of microscopic metallographic tests of hardfaced layers. The above-named tests revealed that the structure of the overlay welds was composed of tungsten carbide particles in a matrix consisting of chromium carbides (Cr_7C_3) and austenite. The flux-cored hardfaced layers (where tungsten carbide particles were fed to the overlay weld pool) were characterised by very high metal-mineral type abrasive wear resistance (regardless of the degree of overlay weld wear). The aforesaid hardness was, on average, between 5.0 and 6.0 times higher than that of the overlay welds made only using the flux-cored wire (i.e. without feeding the particles of tungsten carbide to the weld pool). The results obtained in the tests concerning the structure and properties of the composite overlay welds were used to develop technological guidelines concerning the low-pressure hardfacing of layers characterised by high metal-mineral type abrasive wear resistance, regardless of the overlay weld wear degree.

Keywords: hardfacing, composite layers, tungsten carbide, chrome cast iron